

Physics Advisory Committee

June 22-25, 2015

CHARGE

The laboratory continues to develop a program that is aligned with the recommendations in the Particle Physics Project Prioritization Panel (P5) report: *“Building for Discovery: Strategic Plan for U.S. Particle Physics in the Global Context.”* Within this context there are two major new initiatives for the Fermilab hosted neutrino program: (i) a new long-baseline experimental facility (LBNF) and experiment (DUNE), and (ii) an expanded short-baseline program that complements MicroBooNE with the addition of near and far detectors (SBND and ICARUS, respectively). These initiatives are progressing. A major focus for the present PAC meeting is to consider the progress and plans for the next steps.

The ongoing Fermilab neutrino program consists of the laboratories flagship experiment (NOvA), two other NuMI experiments (MINOS+ and MINERvA), and the new short baseline experiment (MicroBooNE). The PAC will hear updates on each of these experiments, and is asked to consider the long-term future of MINERvA, including the proposed CAPTAIN-MINERvA extension to the experiment, and future antineutrino running.

In the medium term, two new muon experiments will be added to the Fermilab program: g-2 and Mu2e. We ask the PAC to comment on progress towards realizing these experiments and achieving their scientific goals.

The P5 report identified the LHC experiments as the highest near-term priority. We ask the PAC to consider the status of the CMS Phase 2 upgrades and the physics activities of the Fermilab group in CMS.

In January the PAC requested a more detailed activity plan for particle astrophysics at Fermilab. The committee will be given an update on the particle astrophysics plan.

Finally, at this meeting there is one new LOI (P-1067: Direct Search for Dark Photon & Dark Higgs) to consider.

Specifically, we ask the PAC to consider the following:

1. Short-Baseline Program

i) We ask the PAC to comment on the current situation and on the progress being made on MicroBooNE, SBND, and ICARUS.

ii) Is the path to Stage 2 approval for SBND and ICARUS (and extended MicroBooNE running) clear and appropriate?

iii) Is there an adequate plan for the three collaborations to develop a strategy of cross calibrations that will lead to an understanding of the relative acceptances at the required level?

2. Future Long-Baseline Program.

i) We ask the PAC to comment on the current situation and on the progress being made by the collaboration to form Working Groups to address the open R&D questions.

ii) Is the documented science program for DUNE clear and compelling?

iii) Does the collaboration have a clear strategy, and associated plans, to explore how to achieve the required small systematic errors?

iv) Are there additional actions the laboratory should take to strengthen the internationalization of the LBNF/DUNE program?

3. LOI: Direct Search for Dark Photon & Dark Higgs Particles with the SeaQuest Spectrometer in Beam (P-1067)

We ask the PAC to comment on whether the science goals are compelling, the scope and appropriateness of the support requested, and the compatibility of this new initiative with the previously proposed SeaQuest running with a polarized target.

4. NOvA, MINOS+, g-2, and Mu2e

We ask the PAC to comment on the current situation and on the progress being made. In addition, for MINOS+, we ask the PAC to comment on the collaborations scientific goals given realistic expectations for their last year of data taking.

5. PROPOSAL: CAPTAIN-MINERvA (P-1061)

We ask the PAC to consider this proposal in the context of the overall MINERvA run plan. Specifically, for P-1061:

- i) Is the science in the proposal interesting and/or compelling?
- ii) Is the technique proposed appropriate for, and likely to be capable of, reaching the physics goals of the experiment?
- iii) What is the competition for reaching the physics goals of the proposed experiment? Does the proposed experiment have particular advantages or disadvantages relative to the competition?
- iv) What is needed to make such an experiment successful?

6. MINERvA Antineutrino Running

MINERvA antineutrino running in the ME beam was previously approved, but this was before the realignment of the Fermilab program with the P5 report. We would like the PAC to revisit the MINERvA request to take data when NuMI is running in antineutrino mode.

- i) Is the science case for antineutrino running interesting and/or compelling?
- ii) Given the uncertainties on the beginning and duration of NuMI antineutrino running, what is the minimum amount of antineutrino data (POT) needed for the science case to be strong?
- iii) What is needed to make MINERvA antineutrino running successful?

7. Testbeam Program

The Fermilab Testbeam Facility is a valuable resource for the community. To give advice on the testbeam program, and on the development of the facility, the Fermilab Testbeam Committee was created in 2014. It is intended that a summary of this committee's findings be reported to the PAC once per year. We invite the PAC to comment on this summary.

8. Particle Astrophysics Plan

In January the PAC requested a more detailed activity plan for particle astrophysics at Fermilab. The PAC is asked to comment on progress towards a more complete documented strategic plan for involvement of the laboratory in future particle astrophysics experiments.

For each proposed initiative within the plan:

- i) Is the motivation for the laboratories involvement clear and compelling? Are the associated strategic objectives for the laboratory clear?
- ii) Does the documented plan contain sufficient detail to make clear how the objectives can be achieved? Is the scope of the proposed activity appropriate? Is enough effort foreseen in the plan?

Finally, does the overall plan have a scope, coherence, and impact that is appropriate for Fermilab?

9. CMS

- i) We ask the PAC to comment on the current situation and on the progress being made with the Phase-2 upgrades.
- ii) We also ask the PAC to consider the Fermilab groups physics and analysis activities and comment on the scope and strength of these activities given the size of the group.

10. Other

The Director would welcome any comments the PAC has on any of the topics presented, or comments on aspects of the program beyond the presented topics.